

## **CLAIMS**

What is claimed is:

1. A wire bonding method for use in fabrication of a semiconductor package, comprising the steps of:
  - (1) preparing a substrate composed of a plurality of substrate units, and mounting at least a chip on each of the substrate units;
  - (2) providing a wire bonding station at least having a wire bonding mechanism and a testing mechanism, so as to allow the substrate mounted with the chips to be introduced into the wire bonding mechanism;
  - (3) forming a plurality of bonding wires on one substrate unit of the substrate via the wire bonding mechanism, so as to electrically connect a corresponding chip to the substrate unit;
  - (4) introducing the wire-bonded substrate unit into the testing mechanism for performing an O/S (open/short) test, and forming bonding wires on a next adjacent substrate of the substrate simultaneously moved into the wire bonding mechanism; wherein if test results indicate no occurrence of wire opening or short circuit for the bonding wires formed on the wire-bonded substrate unit, then step (5) proceeds; wherein if the test results indicate occurrence of wire opening or short circuit for the bonding wires on the wire-bonded substrate unit, the testing mechanism is prompted to generate a control signal to the wire bonding mechanism for interrupting a wire bonding process, whereby the wire bonding mechanism is adjusted or repaired, or other causes of wire opening or short circuit are traced and overcome, so as to rework the bonding wires on the wire-bonded substrate unit, and then repeat the step (4);

(5) repeating the step (3) until all the substrate units of the substrate are wire-bonded and tested with the O/S test, and then proceeding with step (6); and

(6) moving the wire-bonded and tested substrate out of the wire bonding station, for allowing the substrate to be used in subsequent package fabrication.

2. The wire bonding method of claim 1, wherein the testing mechanism includes at least a test socket and a tester electrically connected to the test socket.

3. The wire bonding method of claim 2, wherein the test socket is used to come into contact with the wire-bonded substrate unit, allowing the tester to perform the O/S test for the bonding wires on the substrate unit through the test socket.

4. The wire bonding method of claim 2, wherein the tester at least includes:

a testing module electrically connected to the test socket, for performing the O/S test through the test socket; and

a controlling module electrically connected to the testing module and the wire bonding mechanism, for receiving a test-failure signal from the testing module in occurrence of wire opening or short circuit, and generating a control signal to the wire bonding mechanism, so as to interrupt the wire bonding process in the wire bonding mechanism.

5. The wire bonding method of claim 2, wherein the tester is further electrically connected to a test socket of at least another wire bonding station, so as to simultaneously control test sockets in a plurality of wire bonding stations for performing the O/S test.

6. The wire bonding method of claim 1, wherein the wire bonding station further includes a handling mechanism for moving the substrate into or out of the wire bonding station.

7. The wire bonding method of claim 1, wherein the wire bonding station is a wire bonding machine internally provided with the testing mechanism, and the testing mechanism is disposed at a downstream position relative to the wire bonding mechanism in the wire bonding machine.
8. The wire bonding method of claim 1, wherein the wire bonding station includes a wire bonding machine internally provided with at least a test socket, and a tester externally connected to the wire bonding machine and electrically connected to the test socket, which test socket is disposed at a downstream position relative to the wire bonding mechanism.
9. The wire bonding method of claim 1, wherein in the step (4), upon receiving the control signal from the testing mechanism, the wire bonding mechanism interrupts the wire bonding process after the next adjacent substrate unit is completely wire-bonded.
10. The wire bonding method of claim 1, wherein the substrate units of the substrate are arranged in a matrix type.
11. The wire bonding method of claim 1, wherein the substrate units of the substrate are arranged in a single-array type.
12. A wire bonding method for use in fabrication of a semiconductor package, comprising the steps of:
  - (1) preparing a substrate composed of a plurality of substrate units, and mounting at least a chip on each of the substrate units;
  - (2) providing a wire bonding station at least having a wire bonding mechanism and a testing mechanism, so as to allow the substrate mounted with the chips to be introduced into the wire bonding mechanism;

(3) forming a plurality of bonding wires on one substrate unit of the substrate via the wire bonding mechanism, so as to electrically connect a corresponding chip to the substrate unit;

(4) introducing the wire-bonded substrate unit into the testing mechanism for performing an O/S (open/short) test, and forming bonding wires on a next adjacent substrate of the substrate simultaneously moved into the wire bonding mechanism; then, displaying test results via the testing mechanism;

(5) repeating the step (4) until all the substrate units of the substrate are wire-bonded and tested with the O/S test, and then proceeding with step (6); and

(6) moving the wire-bonded and tested substrate out of the wire bonding station; reworking wire-opened or short-circuited substrate units, and overcoming causes of wire opening or short circuit according to the displayed test results by the testing mechanism in the step (4).

13. The wire bonding method of claim 12, wherein the testing mechanism includes at least a test socket and a tester electrically connected to the test socket.

14. The wire bonding method of claim 13, wherein the test socket is used to come into contact with the wire-bonded substrate unit, allowing the tester to perform the O/S test for the bonding wires on the substrate unit through the test socket.

15. The wire bonding method of claim 13, wherein the tester at least includes:

- a testing module electrically connected to the test socket, for performing the O/S test through the test socket; and
- a displaying module connected to the testing module, for displaying test results from the testing module.

16. The wire bonding method of claim 13, wherein the tester is further electrically connected to a test socket of at least another wire bonding station, so as to simultaneously control test sockets in a plurality of wire bonding stations for performing the O/S test.

17. The wire bonding method of claim 12, wherein the wire bonding station further includes a handling mechanism for moving the substrate into or out of the wire bonding station.

18. The wire bonding method of claim 12, wherein the wire bonding station is a wire bonding machine internally provided with the testing mechanism, and the testing mechanism is disposed at a downstream position relative to the wire bonding mechanism in the wire bonding machine.

19. The wire bonding method of claim 12, wherein the wire bonding station includes a wire bonding machine internally provided with at least a test socket, and a tester externally connected to the wire bonding machine and electrically connected to the test socket, which test socket is disposed at a downstream position relative to the wire bonding mechanism.

20. The wire bonding method of claim 12, wherein the substrate units of the substrate are arranged in a matrix type.

21. The wire bonding method of claim 12, wherein the substrate units of the substrate are arranged in a single-array type.

22. A wire bonding method for use in fabrication of a semiconductor package, comprising the steps of:

- (1) preparing a substrate composed of a plurality of substrate units, and mounting at least a chip on each of the substrate units;

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(2) providing a wire bonding station at least having a wire bonding mechanism and a testing mechanism, so as to allow the substrate mounted with the chips to be introduced into the wire bonding mechanism;

(3) forming a plurality of bonding wires on one substrate unit of the substrate via the wire bonding mechanism, so as to electrically connect a corresponding chip to the substrate unit;

(4) introducing the wire-bonded substrate unit into the testing mechanism for performing an O/S (open/short) test, and forming bonding wires on a next adjacent substrate of the substrate simultaneously moved into the wire bonding mechanism;

(5) proceeding with step (7) if test results indicate no occurrence of wire opening or short circuit for the bonding wires formed on the wire-bonded substrate unit; wherein, if no wire opening or short circuit occurs; or else, a controlling module of the testing mechanism determining if a pre-inputted command to the testing mechanism is to interrupt a wire bonding process in the wire bonding mechanism; wherein, if the pre-inputted command is interruption of the wire bonding process, then step (6) proceeds; or else, step (9) proceeds;

(6) generating a control signal via the controlling module of the testing mechanism to the wire bonding mechanism for interrupting the wire bonding process, so as to trace and overcome causes of wire opening or short circuit, and to rework the wire-bonded substrate unit; then repeating the step (4);

(7) repeating the step (3) until all the substrate units of the substrate are wire-bonded and tested with the O/S test, and then proceeding with step (8);

(8) moving the wire-bonded and tested substrate out of the wire bonding station, for allowing the substrate to be used in subsequent package fabrication;

(9) displaying test results produced from the step (5) via a displaying module of the testing mechanism, and repeating the step (3) until all the substrate units of the substrate are wire-bonded and tested with the O/S test; then proceeding with step (10);

(10) moving the wire-bonded and tested substrate out of the wire bonding station; and

(11) reworking wire-opened or short-circuited substrate units, and tracing and overcoming causes of wire opening or short circuit according to the displayed test results by the displaying module of the testing mechanism.

23. The wire bonding method of claim 22, wherein the testing mechanism includes at least a test socket and a tester electrically connected to the test socket.

24. The wire bonding method of claim 23, wherein the test socket is used to come into contact with the wire-bonded substrate unit, allowing the tester to perform the O/S test for the bonding wires on the substrate unit through the test socket.

25. The wire bonding method of claim 23, wherein the tester at least includes the controlling module, the displaying module and a testing module, the testing module being electrically connected to the test socket so as to perform the O/S test for the substrate unit through the test socket, and transmit test results to the controlling module and the displaying module.

26. The wire bonding method of claim 23, wherein the tester is further electrically connected to a test socket of at least another wire bonding station, so as to simultaneously control test sockets in a plurality of wire bonding stations for performing the O/S test.

27. The wire bonding method of claim 22, wherein the wire bonding station further includes a handling mechanism for moving the substrate into or out of the wire bonding station.

28. The wire bonding method of claim 22, wherein the wire bonding station is a wire bonding machine internally provided with the testing mechanism, and the testing mechanism is disposed at a downstream position relative to the wire bonding mechanism in the wire bonding machine.

29. The wire bonding method of claim 22, wherein the wire bonding station includes a wire bonding machine internally provided with at least a test socket, and a tester externally connected to the wire bonding machine and electrically connected to the test socket, which test socket is disposed at a downstream position relative to the wire bonding mechanism.

30. The wire bonding method of claim 22, wherein in the step (6), upon receiving the control signal from the controlling module of the testing mechanism, the wire bonding mechanism interrupts the wire bonding process after the next adjacent substrate unit is completely wire-bonded.

31. The wire bonding method of claim 22, wherein the substrate units of the substrate are arranged in a matrix type.

32. The wire bonding method of claim 22, wherein the substrate units of the substrate are arranged in a single-array type.

33. A wire bonding system for use in fabrication of a semiconductor package, comprising:

a handling mechanism for moving a substrate into or out of the wire bonding system, the substrate being composed of a plurality of substrate units, with each of the substrate units being mounted with at least a chip;

a wire bonding mechanism for forming bonding wires on the substrate introduced by the handling mechanism, allowing each of the chips to be electrically connected to the corresponding substrate unit by the bonding wires; and

at least a test mechanism for performing an O/S (open/short) test for the bonding wires formed on the substrate introduced by the handling mechanism, the test mechanism being disposed at a downstream position relative to the wire bonding mechanism, wherein, when the test mechanism proceeds with the O/S test for a wire-bonded substrate unit, the wire bonding mechanism simultaneously forms bonding wires on a next adjacent substrate of the substrate, so that test-performing time is included in wire-bonding time for a substrate unit.

34. The wire bonding system of claim 33, wherein the testing mechanism includes at least a test socket and a tester electrically connected to the test socket.

35. The wire bonding system of claim 34, wherein the test socket is used to come into contact with the wire-bonded substrate unit, allowing the tester to perform the O/S test for the bonding wires on the substrate unit through the test socket.

36. The wire bonding system of claim 34, wherein the tester at least includes:

- a testing module electrically connected to the test socket, for performing the O/S test through the test socket; and
- a controlling module electrically connected to the testing module and the wire bonding mechanism, for receiving a test-failure signal from the testing module in occurrence of wire opening or short circuit, and generating a control signal to the wire

bonding mechanism, so as to interrupt a wire bonding process in the wire bonding mechanism.

37. The wire bonding system of claim 36, wherein upon receiving the control signal from the testing mechanism, the wire bonding mechanism interrupts the wire bonding process after the next adjacent substrate unit is completely wire-bonded.

38. The wire bonding system of claim 34, wherein the tester at least includes:

- a testing module electrically connected to the test socket, for performing the O/S test through the test socket; and
- a displaying module connected to the testing module, for displaying test results from the testing module.

39. The wire bonding system of claim 34, wherein the tester is further electrically connected to a test socket of at least another wire bonding station, so as to simultaneously control test sockets in a plurality of wire bonding stations for performing the O/S test.

40. The wire bonding system of claim 33, wherein the substrate units of the substrate are arranged in a matrix type.

41. The wire bonding system of claim 33, wherein the substrate units of the substrate are arranged in a single-array type.